

Computer Software Genres That Help Students **Think!**

by Carol A. Brown

A genre is a classification system that places different instructional materials into neat categories that help teachers choose what to use and when. Content area, developmental level, and student interests often drive these decisions. Similarly, computer software can be placed within genres to aid teachers in

selecting the best resource for a particular thinking skill or process.

Core thinking skills, for example, are used for surface-level thinking, such as organizing a list of supplies and resources needed for a science project. Complex processing would be required to generate a display describing the project's hypothesis,

method of investigation, and summary of conclusions. Each level of processing is important for successfully completing a science project. When planning computer-integrated lessons associated with various levels of thinking, teachers should consider which software is most appropriate.

Drill and Tutorial

Core thinking skills often are matched with software genres that promote quick recall of basic facts and that have great potential for automatizing certain skills (Sewell 1990). Mental energy used to rehearse the steps of a procedure or recall the attributes of a simple concept drains the energies needed for higher-level processes (Mayer 2002). When students can complete a task automatically (e.g., steps in long division) and recall necessary facts efficiently (e.g., multiplication tables), the cognitive load is reduced, leading to increased mental energy and thinking capacity (Park and Hannafin 1993).

Software categories within this genre include drills, multimedia tutorials, learning games, reading management programs (e.g., Accelerated Reader™), and integrated learning systems. When using integrated learning systems (e.g., SuccessMaker® Enterprise by Pearson; Academy of READING® by AutoSkill®), the classroom teacher might consider presenting the tutorial lesson using a digital projector or large-screen monitor for whole-class or small-group instruction. Most integrated learning systems have options for altering or delaying the sequence of skills, which allows the teacher to guide class discussion while progressing through the software.

To select skills-based software confidently, follow these rules of thumb:

- Make sure that the software includes instructions.
- Evaluate the software in advance to ensure that feedback on incorrect answers prompts students to try again or search for the correct answer.
- Several practice sets should be presented before scoring is recorded.

Do not use drill-in-practice software for teaching new skills and concepts;

rather, this type of software should be saved for practice and review. Use tutorials for enhancing what has been taught by the teacher or to reinforce concepts with students in need of additional instruction. Use drills for basic recall, such as math facts, states and their capitals, or typing skills. The computer never should be used as a replacement for the teacher (Vockell and Van Deusen 1989). Even the most sophisticated tutorials are unable to respond to students in the reciprocal manner of a live teacher.

Productivity

Productivity software includes word processing, spreadsheet, and database applications. The efficient use of spelling and grammar checks in word processors allows students to devote full mental energies to the writing process. Because less energy is expended on writing mechanics, more energy is available for comprehension, as students produce summaries and outlines from information received in class or from reading assignments.

Spreadsheets can be helpful in understanding how numeric variables are interrelated and how changes in outcomes can be predicted. Charts and graphs generated by spreadsheet applications are excellent tools for helping students think about what the numbers represent. When students use database applications (e.g. Microsoft® Access or Works) to design their own files, considerable thought must be given to category names and how assigning field names impacts successful queries. Productivity software can enhance core thinking and facilitate the transition to more complex thinking processes.

Generative

Generative software includes computer resources that help students construct (or generate) new ideas and understanding of a topic. Computerized simulations

are excellent tools for modifying inaccurate mental models and aligning these with scientifically accurate models (Mayer 2002). Students must generate solutions to real-world problems based on logic and analytical thinking skills. These programs are especially useful when the topic is immersed in a dangerous environment or when interaction is physically impossible. The sounds, sights, and smells associated with the Amazon rainforest or a virtual field trip to a seemingly impossible location for a group of school children are examples of how generative software can be used in the classroom.

Inquiry learning requires gathering and presenting informational materials for a project or problem statement. One popular model for inquiry-based learning is the WebQuest project (Milson and Downey 2001). Projects available from the official WebQuest site (<http://webquest.sdsu.edu>) are well-designed and include all the components for engaging students in meaningful thinking processes. For older students, the design and development of an original WebQuest project takes complex thinking to a higher dimension and requires processes for identifying the problem and evaluating the resources needed to generate solutions. The student assumes the role of both tutor and tutee, leading to authentic learning experiences. The teacher facilitates both processes, which is representative of what students will

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encounter in their future professions and workplaces.

As a culminating activity for inquiry-based projects, students should be able to report their findings in a logical and elaborative presentation. Elaboration refers to thinking processes that require students to add new and original ideas to enhance basic information gathered from an outside source. Presentation software (e.g., Microsoft® PowerPoint®) can be used

Organization and Integration

Specific genres of software can help students see patterns and identify connections between pieces of information through the organizational process. Flowcharting software, such as Inspiration® or Thinking Maps®, generates graphic organizers. These tools are excellent for helping students to make connections between basic facts

for students. The main advantage of portfolio assessment, however, is in the metacognitive processes that enable students to match the quality of their work to a content area, standard, or competency.

Final Thoughts

Most teachers are hard-pressed to successfully incorporate both problem solving and basic skill mastery during the instructional minutes available during the school week. The pressure of preparing students for recall and application of knowledge can be reduced by planning instruction around core and complex thinking processes. Students need both levels to be successful problem solvers and to master basic knowledge and skills (North Central Regional Educational Laboratory 1999).

To effectively integrate computers into teaching, students' thinking skills must be a priority. The goal is to align thinking processes appropriately with the software's function. By categorizing software by genre and matching it to the desired thinking skills, teachers can plan lesson activities which teach discrete skills as well as complex processes that will prepare students for a lifetime of problem solving.

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to enhance elaborative thinking by generating dynamic electronic displays. When students expand on an idea using analogy, examples, and visual representations, recall improves and performance on tests is better (Morrison, Lowther, and DeMeulle 1999).

Information Gathering

Internet tools for information gathering can help students understand a particular topic or concept. Curriculum Pathways®, a product of SAS inSchool® (www.sasinschool.com/index.shtml), is Web-based software with in-depth support for the teacher and rich multimedia tutorials for students. Before completing lessons, students must sift through information to determine what is important and relevant to a particular problem statement and locate what might be needed for answering specific research questions. Analytical thinking to differentiate relevant from irrelevant information requires complex processes typical of academic work in higher education and within most professional settings.

and related descriptive information included in a K-12 standard curriculum.

Using hypermedia resources also enhances the processes for making mental connections and adding new information to current understanding. Electronic encyclopedias and online informational resources often have links to supporting information (scaffolds) that help students build a personal understanding of new ideas and concepts.

Evaluative and Reflective

Reflective thinking often is associated with the use of electronic portfolios. Teachers can extend portfolio assessment to include metacognitive processes that help the student evaluate whether his or her work is representative of a curriculum competency or skill (Hebert 2001). Electronic portfolios can be as simple as a word-processed file with hyperlinks or an elaborately designed multimedia product complete with narration and video. Developing electronic files can be time-consuming, but quite motivational

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